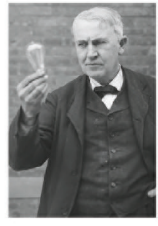


RECOGNIZING SCIENCE: American Scientific Achievement and the Role of The National Park Service

A Report

of the

National Park System Advisory Board

Science Committee

National Park System *Advisory Board*

Citizen advisors chartered by Congress to help the National Park Service care for special places saved by the American people so that all may experience our heritage.

November 2015

Honorable Jonathan Jarvis
Director, National Park Service
Washington, DC

Dear Director Jarvis,

On behalf of the National Park System Advisory Board and its Science Committee, we present to you a report entitled *Recognizing Science: American Scientific Achievement and the Role of the National Park Service.*

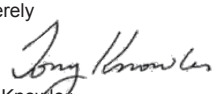
Science and scientific achievement have always been part of the American experience. The National Park Service-including its National Park System, historic preservation programs, and site designations-has a lead responsibility in recognizing science and scientific achievement as part of the Nation's history.

Several science-related sites have already been formally recognized. However, recognition of American science by preserving appropriate historic sites is, as noted in your charge to the Board, "significantly incomplete." In particular, women and persons of color who have contributed to advancement of American science are under-represented. Hence, your charge was to prepare a report that included specific sites and scientists for consideration for recognition, as well as recommendations on how to use those designated sites as portals for science, technology, engineering, and mathematics education.

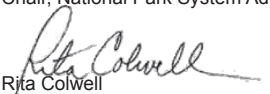
The Board's Science Committee, which included historians of science and representatives of professional scientific societies, met in Washington, DC, and held conference calls to develop their recommendations. The final report received full endorsement of the Science Committee and National Park System Advisory Board.

Site suggestions and additional recommendations are included in the report, and are intended to enhance the role of the National Park Service in educating and inspiring the next generation and build public support for science. Recognizing historical scientific achievement in the parks and programs of the National Park Service is both a continuation of the American story, and a significant investment in the future of our nation.

Sincerely



Tony Knowles
Chair, National Park System Advisory Board



Rita Colwell
Chair, Science Committee
National Park System Advisory Board

1849 C Street, NW I Room 2719 I Washington, DC 20240

RECOGNIZING SCIENCE: American Scientific Achievement and the Role of The National Park Service

A Report
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National Park System Advisory Board
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December 15, 2015

Introduction

Science and scientific achievement have always been a part of the American experience. Many of the Founding Fathers were familiar with science, and several were skilled in scientific research. Benjamin Franklin was internationally known for his scientific studies, and founded the American Philosophical Society (at the time the nation's most prestigious scientific academy) in 1743. Thomas Jefferson was elected Vice-President of the United States and president-elect of the Society in the same year (1797), and made significant contributions to natural history. John Adams and James Madison had strong scientific educations that influenced their contributions to the writing of the Constitution.

As the nation grew, so did the role of science in its development. The Lewis and Clark Expedition and its "Corps of Discovery" (1804), the research of George Washington Carver (1860-1943), the "scientific forestry" of Gifford Pinchot (1865-1946), the Manhattan Project of WWII resulting in the atomic bomb (1942-1946), and the environmental science of Rachel Carson (1907-1964) all played a part in American history. Including science in the telling of the American story is both a responsibility and opportunity; recognizing scientific achievement by preserving historic resources in the United States is a task shared by many institutions.

The National Park Service (NPS)—including its National Park System (with 409 units) and historic preservation programs and site designations—has a lead responsibility in recognizing science and scientific achievement. Science and scientific achievement are part of existing "themes" that help frame NPS historical conservation. There are numerous existing sites that are science-related and formally recognized: Thomas Edison's laboratory is a National Historical Park, Charles Best's home is on the National Register of Historic Places, and John Burroughs' cabin (named "Slabsides") is a National Historic Landmark, for example.

Yet the recognition of American science through preservation of appropriate historic sites is, as NPS Director Jonathan Jarvis has noted, "significantly incomplete." The achievements of scientists such as Luis Alvarez, Grace Hopper, Richard Feynman, and Barbara McClintock are not yet stories generally known or told through the NPS. Women and persons of color that have contributed to the advancement of American science are underrepresented.

The responsibility of the National Park Service is not just to complete an "inventory" of important scientists and commemorative sites. Such sites, scientists and their stories are invaluable opportunities to introduce visitors—particularly young visitors—to learning about science, scientific careers, and the importance of science

to the nation's future. They can serve as "transformative portals" to science, technology, engineering, and mathematics (STEM) education—educating and inspiring future generations. These historic sites can help educate citizens on the methods and limitations of science, and increase understanding and support for the scientific enterprise. Expanding recognition of science and scientific achievement in the historic programs of the NPS both advances the mission of the National Park Service and serves the civic good.

The scope and purpose of this report

This report recommends two ambitious goals for the NPS: *1) to increase recognition, public awareness, and appreciation of the significant contributions of diverse fields of science and diverse scientists to the health, wealth, and quality of life of all Americans, and 2) to help build public understanding of and support for science.* Both goals can be furthered by recognizing additional sites of American science and scientific achievement, and by developing additional educational and interpretive programs that treat these sites as STEM portals.

In this report, *science* refers to the full range of major disciplines including chemistry, physics, astronomy, computer and information science, engineering, life sciences (including medical science), geosciences, mathematics, the social, cultural, and economic sciences, and interdisciplinary science. *Scientific achievement* refers to the accomplishments of a scientist, team of scientists, or scientific institution, where these accomplishments significantly advance science and/or serve society.

The report is organized as follows. After this introduction, a brief overview of the various historical designations available to the NPS is presented. Next, the methods used to develop the report's recommendations are described, as well as the involvement of numerous scientific societies. The criteria for selecting a short list of sites to recommend for recognition are explained.

Following these introductory sections, 12 potential sites are highlighted for consideration by the NPS for possible recognition or, in cases of existing sites, expanded recognition. For each site, brief background information is provided to help identify why the site is an excellent candidate for recognizing scientific achievement and serving as a transformative STEM portal. Following these site recommendations, additional recommendations on delivering STEM education, engaging scientific societies,

and preparing for additional site recognition are presented. A brief conclusion ends the report.

The NPS has a thorough and detailed process for evaluating historic sites for recognition, and the National Historic Landmarks Committee of the National Park System Advisory Board, and the Board itself, have significant responsibilities and expertise. This report does not substitute for the necessary engagement with property owners, assessments and evaluations by NPS professionals, program leaders, and recommendations by the National Historic Landmarks Committee. It is a complement to that process, and provides advice and guidance from the scientific community on potential historic sites that could be considered for such studies and possible designations.

Alternative opportunities for recognition

There are several opportunities under federal law for gaining national recognition for historic sites of significant scientific achievement in America. These forms of recognition provide several designation alternatives to the NPS for recognizing science.

The *National Register of Historic Places* (NRHP) was authorized by the National Historic Preservation Act of 1966 (NHPA) to serve as America's official list of historic properties recognized as worthy of preservation. The National Register program is administered by the NPS, in cooperation with federal, state, and tribal Historic Preservation Offices. Currently there are approximately 90,000 historic districts and properties listed on the National Register. Properties can be nominated to the Register by anyone. A nomination includes extensive documentation that is prepared for submission to the appropriate nominating official (a Historic Preservation Officer), who determines that the property is qualified, and transmits the nomination to NPS for possible listing in the Register. Such sites are determined to be of local, state, or national significance through the review process. If nominated sites are on private lands, landowner permission is required prior to official listing, though a site may be "determined eligible" for listing regardless.

National Historic Landmarks are the nationally significant historic sites listed on the National Register. Under the National Historic Preservation Act, the Secretary of the Interior makes the final determination of a site's qualification and national significance, based upon a recommendation from the Historic Landmarks Committee of the National Park System Advisory Board, which undertakes an extensive review of nomination data compiled by NPS professionals and others.

National Historic Sites are historic places of national significance on federal lands. National Historic Sites can be designated by an act of Congress, and the Secretary of the Interior can make this designation administratively through issuance of a Secretarial Order, under authority granted by the Historic Sites Act of 1935. Most such sites designated by the Secretary have later become units of the National Park System by acts of Congress.

National Monuments are proclaimed by the President under authority granted exclusively to that Office by the Antiquities Act of 1906. Such sites occur only on federal lands, though these may be donated to the federal government by state governments, local governments, or private individuals prior to such national monument proclamation.

National Parks or a variety of other nomenclature designations, such as National Historic Park, occur by individual Acts of Congress and signed into law by the President. Prior to designation, Congress may authorize NPS to conduct a "special resources study" of the proposed site, in order to determine national significance, feasibility, and suitability for management as a unit of the National Park System.

Individual sites may be only appropriate for one of these designations; other sites may be appropriate for multiple designations. Often a site is first recognized on the

National Register, then as a National Landmark, and sometimes a National Historic Site or even National Park status. All of these alternatives for designation are opportunities for recognizing scientific achievement in the United States.

Identifying potential candidate sites

To help identify potential candidate sites, the Science Committee engaged representatives of professional scientific societies, the historic preservation community, and historians of science. NPS historical preservation staff provided technical assistance. The Committee (and its expanded group of representatives, see Appendix 1) met by phone and in person to discuss the Director's charge, criteria for selection, and initial candidate sites. Committee members were encouraged to submit additional candidates via email, and a list of approximately 180 potential sites was assembled. In some cases, a scientist was identified as worthy of recognition but a specific site linked to that scientist was to be decided after additional study. Each site or scientist was placed in an appropriate major scientific discipline, based on categories of the National Science Foundation Supported

Disciplines: 1) chemistry, 2) computer and information science, 3) engineering, 4) geosciences, 5) life sciences, 6) mathematical sciences, 7) physics and astronomy, 8) psychology, and 9) social sciences (see Appendix 2).

The committee agreed on criteria to be used to select a short list of sites and/or scientists for possible recognition. The criteria reflect the charge to the National Park System Advisory Board and the Science Committee by NPS Director Jarvis. Three criterion were used:

Criterion A: *The site represents significant American scientific achievement.*

- Significant scientific achievement reflects the application of the scientific method, theoretical and/or applied research, and lasting influence upon science and/or society.
- Scientific achievement in the full range of physical sciences, life sciences, engineering and computer sciences, mathematics, and social sciences were eligible.
- The achievement could be in theory, methods, empirical results, and/or application.

Criterion B: *The site has potential for advancing STEM education in multiple fields of science.*

- Potential for STEM education reflects the opportunities provided by the site for:

- engaging young people
- increasing public understanding and support for science, encouraging careers in science, and linking the site to multiple fields of science.

Criterion C**:** *The site represents diversity in American scientific achievement*.

- Diversity in scientific achievement reflects the contribution of:
  - women
  - persons of color
  - members of the LGBT community
  - other underrepresented groups

The individual committee members evaluated the list of potential sites and/or scientists. Each committee member evaluated those sites within their particular discipline and other sites for which they had sufficient knowledge. From this evaluation, a short list of 20 sites was created. The committee met by phone to discuss each of the sites and/or scientists on this short list, and committee members then individually recommended their top candidates. The final list of 12 candidate sites and/or scientists reflected these recommendations; there was a strong consensus among committee members.

Recommended sites and/or scientists

Luis Alvarez (Site TBD) (Physics and Astronomy)

Luis Walter Alvarez (1911-1988) was an experimental physicist. He worked on a number of WWII radar projects, including what are now known as transponders. He is best known for the radar system, "Ground Controlled Approach" (GCA). He worked with both Enrico Fermi at the University of Chicago on nuclear reactors and Robert Oppenheimer at Los Alamos on the Manhattan Project. He also worked as a member of Project Alberta and observed both the Trinity nuclear test and the bombing of Hiroshima. After WWII, he contributed to work on a liquid hydrogen bubble chamber, which allowed him and co-workers to discover many short-lived particles and resonance states. For this work he was awarded the Nobel Prize in Physics in 1968. In addition, Alvarez is known for breakthroughs in accelerators. With his son Walter and two nuclear chemists, he is also responsible for introducing the hypothesis that the cause for the Cretaceous-Paleogene extinction of the dinosaurs was a meteorite that crashed into Earth 66 million years ago.

Bell Telephone Laboratories, NJ (Engineering)

Bell Telephone Laboratories is a leading research organization in information technology and communications headquartered in New Jersey. Now owned by Alcatel-Lucent, it was originally formed as an amalgamation of engineering departments within AT&T and the Western Electric Company. Researchers were tasked with engineering a communications network built for the national scale. Once the network was established and the telephone industry took hold in the 1920s, the institution turned its focus to the future of information technology and communications and the areas of science most likely to be integral to the future of communications. The organization has since served as a source of significant innovation. Researchers working at Bell Labs such as John Bardeen are credited with inventing radio astronomy, the transistor, lasers, information theory, the C, S, and C++ programming languages, microchips, UNIX, mobile phones, and mobile networks, among others. Eight Nobel Prizes have been awarded for research undertaken or begun at Bell Labs since 1925.

Gertrude Belle Elion (Site TBD) (Life Sciences)

Gertrude Belle Elion (1918 – 1999) was a chemist by training. After completing her master's degree, she began work with George H. Hitchings at the Burroughs-Wellcome pharmaceutical company in North Carolina and subsequently held the position of research professor at Duke University. Her and Hitchings' investigation of pyrimidine and purine as parts of DNA aided in their work to develop many new drugs, including those for AIDS, leukemia, malaria, kidney stones, herpes, and gout. Additionally, Elion aided in the early development of immunosuppressant drugs, which enable patients to receive organs from donors they are not related to. For her work in developing many of these drugs, she was jointly awarded the Nobel Prize for Physiology or Medicine in 1988 along with her colleague George Herbert Hitchings and Joseph Black. She was elected to the National Academy of Science in 1990 and awarded the National Medal of Science in 1991.

Alice Evans (Site TBD) (Life Sciences)

Alice Evans (1881-1975) was a microbiologist. After studying at Cornell University and the University of Wisconsin, she began her career as a part of the United States Department of Agriculture. She studied the bacteriology of milk and milk products, which led her to the discovery of brucellosis in milk. She published her findings in 1918, overturning the supposition that brucellosis in humans was a different disease than in cattle, and increasing awareness about the danger of unpasteurized milk. In the 1930s, when the dairy industry instituted the pasteurization of all milk due to Evans' research, the number of cases of brucellosis decreased dramatically. Evans next worked for the United States Public Health Service beginning in 1918. There, she aided in the study of infectious diseases, including epidemic meningitis and influenza. At the department's Hygienic Laboratories, where she undertook most of her research, she became infected with brucellosis in 1922 and suffered from it for twenty years. She was elected as the first female president of the Society of Microbiology in 1929 and continued work in the field when possible.

Alice Hamilton, Hull House, IL (Social Sciences)

Alice Hamilton (1869-1970) was a physician and activist. She lived and worked at Hull House, the famous settlement house in Chicago, while a Professor of Pathology at Northwestern University's Women's Medical School. Hamilton treated poor immigrants and members of the working class for diseases that were often the result of poor working conditions. Inspired to treat these ailments at their source, she surveyed the extent of industrial sickness from hazardous materials and dangerous occupational procedures through membership and leadership of various commissions. She focused on lead-based industries. Her reports spurred state and federal laws to increase safety of workers and expand measures and medical examinations for workers at risk. She soon became known as the leading authority on industrial diseases, particularly lead poisoning. She lectured as an assistant professor of Industrial Medicine at the Harvard Medical School beginning in 1919, making her the first woman to be on the Harvard faculty, over 30 years before Harvard admitted women as students. She received a Lasker Award for Public Service in 1947.

Ernest Everett Just, Woods Hole, MA (Life Sciences)

Ernest Everett Just (1883-1941) was trained as a biologist. He began his career at Howard University in Washington, D.C., in 1907 and held the position of Head of the Department of Zoology from 1912 until 1929, and again in 1940 until his death. Frank R. Lillie, head of the University of Chicago's Department of Zoology and director of the Marine Biological Laboratory (MBL) at Woods Hole, MA, invited Just to be his research assistant at MBL in 1909. Just spent summers thereafter until 1929 at MBL conducting research, focusing mainly on experimental embryology of marine invertebrate eggs. He received a Ph.D. in zoology from the University of Chicago in 1916, while also upholding his duties at Howard. Just spent the years 1929-1940 in Europe conducting research, largely motivated by experiences with limitations imposed on him due to racism. Just was regarded as the leading authority on the embryology of marine mammals. He advocated for the use of whole cells in research, arguing that the ectoplasm, to which he focused his attention, was of equal importance to the nucleus. Extrapolating this to a broader scale, his lab experiments sought to as closely as possible recreate natural conditions of the phenomena he studied.

Kinsey Institute for Research in Sex, Gender, and Reproduction, IN (Social Sciences)

The Kinsey Institute for Research in Sex, Gender, and Reproduction (originally the "Institute for Sex Research" and also known as "The Kinsey Institute") was established by Alfred Kinsey at Indiana University in 1947 to increase knowledge related to sex and advance sexual health. As first director through 1956, Kinsey and his Institute sparked controversy for openly discussing sexuality and their use of erotic materials in research. The research Kinsey collected through interviews was published in two books, one on sexual behavior in human males and the other on females, commonly referred to as the "Kinsey Reports." The institute has since continued interview-based research and publishing the results as significant works. Under Director June Machover Reinisch (1982-1993), the name was changed to indicate the Institute's expanded focus from sex to include gender and reproduction research. Research has been conducted on at-risk sexual behavior, prenatal exposure to medications and its effects on sexual and psychosexual development, the psychology of sexual behavior, hormonal effects on sex, condom usage, sex in long-term relationships, and hormones and reproduction.

Mauna Loa Observatory, HI (Geosciences)

Mauna Loa Observatory (MLO) is a research station primarily focused on monitoring the atmosphere. The location of MLO is particularly suited for monitoring because of its altitude. It is now part of the Earth System Research Laboratory, a branch of the National Oceanic and Atmospheric Administration (NOAA). Charles David Keeling began overseeing frequent, regular measurements of atmospheric carbon dioxide (CO^2) at MLO in 1958, and readings have continued for over 56 years. The measurements of MLO scientists are the basis of the global atmospheric CO^2 record commonly utilized by climate scientists. Keeling's plotting of this data showing progressive growth in the concentration of CO^2 in the atmosphere is known as the "Keeling Curve." This was the first hard evidence of rapidly increasing CO^2 levels in the atmosphere and provided the basis for initial concern about the possibility of anthropogenic global warming and climate change. Keeling also showed atmospheric carbon dioxide concentrations to be correlated with fossil fuel combustion (and thereby global warming due to the greenhouse effect).

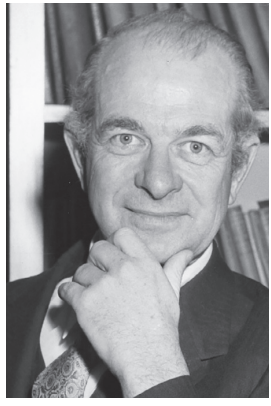
Barbara McClintock, Cold Spring Harbor, NY (Life Sciences)

Barbara McClintock (1902-1992) was a distinguished cytogeneticist. She carried out much of her work as part of the staff of the Carnegie Institution of Washington in Cold Spring Harbor, New York, a laboratory (today called Cold Spring Harbor Laboratory) with research programs that focus on cancer, neuroscience, plant genetics, genomics, and quantitative biology. Starting as an undergraduate at Cornell, she studied the genetics of maize (corn). Her observations of mutation in kernels led her to the discovery of transposable or "jumping" genes: genes that can move within and between chromosomes. Initially, her finding that genes are not stable was discounted because it challenged conventional thinking. It was later confirmed and "jumping genes" were found in microorganisms and insects. Practical implications of her research are widespread, and transposable genes explain many phenomena, such as how resistance to antibiotics can be transmitted between bacteria types that are different. For her groundbreaking work, she won a Lasker Award for Basic Medical Research in 1981 and the Nobel Prize in Physiology or Medicine in 1983.

Margaret Mead (Site TBD) (Social Sciences)

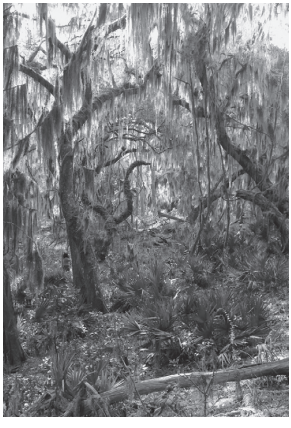
Margaret Mead (1901-1978) was a cultural anthropologist who largely popularized the field in America. Mead focused her research on the ways adolescents are shaped by adult society, child-rearing, and mental and sexual development in different cultures. She sought to understand the human experience holistically, and applied the knowledge she gained through fieldwork to a wide range of issues in modern life. Throughout her career, Mead held many positions, including executive secretary of the National Research Council's Committee on Food Habits, curator of ethnology at the American Museum of Natural History, lecturer at The New School, adjunct professor at Columbia University, Professor of Anthropology and Chair of the Division of Social Sciences at Fordham University's Lincoln Center Campus, and Distinguished Professor of Sociology and Anthropology at the University of Rhode Island. She was elected to the American Academy of Arts and Sciences in 1948 and both the president and chair of the executive committee of the board of directors of the American Association for the Advancement of Science.

Linus Pauling (Site TBD) (Chemistry)



Linus Pauling (1901-1994) was a chemist and activist. As an undergraduate, he studied how the electronic structure of atoms and molecules is related to physical and chemical properties, and his subsequent work largely stemmed from this original interest. Throughout his career, he pioneered the application of quantum theory to the structure of molecules and studied the molecular structures of many substances. Pauling introduced the concept of orbital hybridization and he proposed a scale of electronegativity in 1932, known as the "Pauling Scale," which is still the most commonly used method of calculation and relates to how bonds between atoms and molecules function. Pauling's research on the nature of the chemical bond and its usefulness for understanding molecular structure, for which he won the Nobel Prize in Chemistry in 1954, is largely compiled in *The Nature of the Chemical Bond*. This book is still considered a foundational work in chemistry. He was awarded the Nobel Peace Prize in 1962 for his work to stop nuclear testing, especially concerned about resulting long-term genetic effects. He is the only person to ever have been awarded two unshared Nobel Prizes and one of only two people to be awarded Nobel Prizes in different fields.

Sapelo Island, GA (Life Sciences)



Sapelo Island is a barrier Island seven miles off the coast of Georgia, now jointly owned by the Georgia Department of Natural Resources and National Oceanic and Atmospheric Administration (NOAA). R.J. Reynolds, the tobacco heir, bought the island from its previous owner in 1934 and founded the Sapelo Island Research Foundation in 1949. Subsequently, he funded the research of Eugene Odum and the University of Georgia. Odum's research on Sapelo helped launch systems ecology. He is credited with advancing the term "ecosystem," and advocating for a holistic approach to biological training. He was awarded the Tyler Prize for Environmental Achievement in 1977 and the Crafoord Prize in 1987. The public can now visit Sapelo with an appointment, and the Georgia Department of Natural Resources offers scheduled tours throughout the week.

Recommended actions

Advancing recognition of science and scientific achievement in the United States is and should continue to be an important responsibility of the National Park Service. The scientific community-including professional scientific societies, historians of science, and individual practicing scientists should be enthusiastic advocates and partners for such recognition of science, as well as NPS historic preservation and educational programs. The following are recommended actions.

1. *The National Park Service should carefully review the 12 recommended sites and/or scientists, and select some or all of the sites for detailed review and study for possible listing on the National Register of Historic Places, National Landmark status, or inclusion in the National Park System.* This review, study, and formal nomination process will require resources, and the NPS should provide the necessary support as appropriate and available. In some cases, scientific societies may be able to partner with the NPS and provide technical assistance or other resources in support of the nomination process. In all cases, early engagement of current property owners to assess support for recognition of the potential site will be essential, and should be led by NPS professionals.

2. *The NPS should examine the larger list of candidate sites for additional sites for future review and study,*

leading to possible designation. This list should be periodically updated by the NPS with engagement of the scientific community, historians of science, and property owners, and be publicly available.

3. *The NPS should examine its current interpretative and educational programs at existing sites recognizing science and scientific achievement, and develop expanded, new, and additional programs to use such sites as "transformative portals" for STEM education.* Emphasis should be placed on STEM education for underrepresented youth, to increase the long-term diversity of the scientific community and the National Park Service.

4. *The NPS should prepare and distribute to the public one or more of its regional "heritage travel itineraries" focused on American scientific achievement*. Such an itinerary, with accompanying maps, phone apps, and other interpretive material, can encourage the public (and especially youth and young adults) to visit science sites and learn about the role of science in American history and culture.

5. *The NPS should develop active, on-going engagement and partnerships with professional scientific societies, focused on both recognition of scientific achievement and STEM education within NPS parks and programs*. Possible partners are the American Association for the

Advancement of Science, the Ecological Society of America, the American Geophysical Society, and more. These partnerships can and should create an advocate community for recognizing science within NPS parks and programs, as well as support for science in parks. The professional societies can provide their own and distinctive recognition to selected sites, and can contribute to interpretive and educational programs.

6. *The NPS and the National Park System Advisory Board should prepare and distribute outreach materials to develop support for increased historical recognition of scientific achievement*. This could include distribution of this report, preparation of op-ed pieces and articles for scientific magazines and journals, and commentary through the social media of professional scientific societies.

7. *The NPS should work to complete recognition of selected sites recommended in this report as part of its Centennial Year*. 2016 is the centennial of the NPS, and recognizing scientific achievement can contribute to the NPS centennial goal "to connect with and create the next generation of park visitors, supporters, and advocates".

Conclusion

Science continues to play an important role in the American story. Advances in genomics, climate change research, bioengineering, and other scientific fields will influence industry, business, education, culture, and government, as well as the lives of individual Americans. New discoveries will lead to new questions, for science is a process of "perpetual discovery".

In addition, a new generation of young scientists (necessarily more diverse to reflect the American population) is now preparing to conduct innovative research, lead scientific teams and laboratories, and apply their science to the complex challenges of the times. Historic sites and their interpretation can inspire and educate this next generation, and build public support for science. Hence, recognizing historical scientific achievement through the important role of the National Park Service is both a continuation of the American story, and critical investment in the future of our nation.

Appendix 1
National Park System Advisory Board
Science Committee

Dr. Rita Colwell *(Committee Chair)**
Distinguished University Professor, University of Maryland College Park and Johns Hopkins University Bloomberg School of Public Health; Chairman and President, CosmosID, Inc., College Park, MD

Dr. Susan Avery
President and Director, Woods Hole Oceanographic Institution, Woods Hole, MA

Dr. Joel Berger
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Dr. Thomas Lovejoy*
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Dr. Shirley Malcom*
Head Directorate for Education and Human Resources Programs of the American Association for the Advancement of Science, Washington, DC

Dr. Ann McMullen
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Dr. Michael Novacek
Senior Vice President, Provost of Science, Curator at the American Museum of Natural History, New York, NY

Sir Richard J. Roberts, Ph.D.
1993 Nobel Laureate in Physiology or Medicine, Chief Scientific Officer, New England Biolabs, Ipswich, MA

Dr. Richard Tapia
University Professor, Director of the Center for Excellence and Equity in Education; Director of Alliances for Graduate Education and the Professoriate, Maxfield and Oshman Professor in Engineering, Rice University, Houston, TX

Dr. Gary Machlis (Liaison to the Committee)*
Science Advisor to the Director, National Park Service, Washington, DC

**Subcommittee for the Historic Science Sites Project*

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Dr. David Cantor, Historian, Office of History, National Institutes of Health. Bethesda, MD

Dr. Carol Finn, Senior Research Geophysicist, U.S. Geological Survey and Past-President, American Geophysical Union. Fort Collins, CO

Mr. Destry Jarvis, Consultant, National Parks Conservation Association. Washington, DC

Dr. Peggy Kidwell, Curator, Division of Medicine and Science, National Museum of American History. Washington, DC

Mr. Keith Lindblom, Program Manager, National Historic Chemical Landmarks, American Chemical Society. Washington, DC

Dr. Jonathan Price, President, Geological Society of America. Reno, NV

Ms. Carrie Villar, John & Neville Bryan Senior Manager, Museum Collections, National Trust for Historic Preservation. Washington, DC

National Park Service

Dr. David Gadsby, Archeologist, National Park Service. Washington, DC

Ms. Kassandra Hardy, Management Assistant, National Park Service. Yosemite, CA

Dr. James Jacobs, Historian, Historic American Buildings Survey and National Historic Landmarks Program, National Park Service. Washington, DC

Mr. Paul Loether, Chief, National Register of Historic Places and National Historic Landmarks, National Park Service. Washington, DC

Dr. Daniel Odess, Chief, Cultural Resources Science and Research, National Park Service. Washington, DC

Dr. Stephanie Toothman, Associate Director, Cultural Resources, Partnerships and Science, National Park Service. Washington, DC

Appendix 2
Suggested Historic Science Sites

Sites included in this appendix are in addition to the 12 sites recommended in the report. Sites are listed within NSF Supported Disciplines. Only NSF Supported Disciplines that had suggested sites categorized within them are included. Disciplines and sites are listed in alphabetical, not priority order. If sites are currently on the National Register of Historic Places (NR) or designated as National Historic Landmark (NHL), these designations are shown.

Chemistry

1. **Russell Henry Chittenden House, CT (NR)**
   Known as the father of American biochemistry, he was a professor at Yale University.

2. **Herbert Henry Dow House, MO (NR)**
   He was a chemical industrialist who founded Dow Chemical Company in 1897, and is remembered as a prolific inventor of chemical processes, compounds, and products, as well as a successful businessman.

3. **John William Draper House, NY (NR)**
   He was a chemist who was the first President of American Chemical Society, and is credited with producing the first clear photo of a face and the first detailed photo of the moon.

4. **Irving Langmuir House, NY (NR)**
   He was a physicist-chemist who won the 1932 Nobel Prize in Chemistry for his work in surface chemistry during his career at General Electric, who also invented the gas-filled incandescent lamp and the hydrogen welding technique.

5. **Willard Libby (Site TBD)**
   He was a physical chemist whose lead role in developing radiocarbon dating led to the Nobel Prize in Chemistry in 1960.

6. **Joseph Priestley House, PA (NHL)**
   In 1774, he discovered oxygen, and later developed the carbonation process, identified carbon monoxide and other gases, conducted early experiments in electricity, and achieved an early understanding of the interrelationship of plants and animals mediated by gases.

7. **University of Virginia Rotunda, VA (NHL)**
   An early architectural example of publicly funded secular education in the US.

Engineering

8. **Alexander Graham Bell (Site TBD)**
   He was inventor of the first practical telephone and metal detector, did groundbreaking work in optical telecommunications, hydrofoils, and aeronautics, and was one of the founding members of National Geographic Society.

9. **George Eastman House, NY (NR)**
   House of the founder of Eastman Kodak Company that is now the location of the George Eastman House International Museum of Photography and Film, one of the oldest museums dedicated to collecting, preserving, and presenting the history of photography and film.

10. **R.A. Fessenden House, MA (NR)**
    A physicist who performed pioneering experiments in radio, including use of continuous waves and is credited with the first AM radio transmissions of voice and music.

11. **General Electric Research Laboratory, NY**
    This was the first industrial research facility in the United States, established in 1900.

12. **The Harvard Computation Laboratory, MA**
    This is the facility where Dr. An Wang developed the core memory of computers.

13. **The Machine room, a building on Olden Lane near the Institute for Advanced Study in Princeton, NJ**
    This research facility is associated with John Von Norman and the IAS computer.

14. **Samuel P. Morse House, NY**
    He was the inventor who co-developed Morse code, and helped develop commercial use of telegraphy.

15. **Research Laboratory of Physics, Harvard (later the Lyman Laboratory of Physics), MA**
    This is where Grace Hopper, Howard Aiken, and their colleagues worked on the ASSC Mark I computer during World II, and later the Mark II.

16. **Count Benjamin Rumford Birthplace, MA**
    An 18th century US physicist, inventor, and British spy who performed groundbreaking research into the design of heating systems, fostering the development of the Rumford stove.

17. **Charles H. Townes (Site TBD)**
A physicist who worked on radar bombing systems at Bell Labs during WWII and created the maser with Nikolay G. Basov and Aleksandr M. Prokhorov, for which they won the Nobel Prize in Physics in 1964, and later pioneered use of masers and lasers in astronomy.

18. **Trinity Site, NM**
Site of the first detonation of a nuclear weapon test (code named Trinity), conducted by the United States Army on July 16, 1945 as part of the Manhattan Project.

Geosciences

19. **Cleveland Abbe House, DC (NR)**
He was founder of the US Weather Bureau.

20. **Agassiz Bedrock Outcrop Research site, ME**
The field research site of Louis Agassiz that is a geographic feature significant in the history of geology - an outcrop of the Ellsworth schist marked with striations created by glacial action between 25,000 and 13,000 years ago.

21. **Atomic Energy Commission Geophysical Laboratory, Carnegie Institution of Washington, DC**
The laboratory of Director Phil Abelson who was a leader in chemistry, physics, geophysics, and geochemistry and was instrumental in uranium-isotope separation for the first atomic bomb.

22. **Beecher's Trilobite Bed, NY**
The site is named for Charles Emerson Beecher who found exceptionally preserved trilobites in the bed that have facilitated soft tissue study.

23. **Nathaniel Bowditch House, MA (NR)**
A self-taught 18th century astronomer and founder of modern navigation who was President of the American Association for the Advancement of Science.

24. **Channeled Scablands, WA**
An important field research site investigated by J. Harlen Bretz that exhibited scouring from the cataclysmic Missoula Floods.

25. **Cosmos Club, DC (NR)**
Founded by John Wesley Powell, this social club facilitated scientific discussions, and was where The National Geographic Society was founded in 1888 and the Wilderness Society was founded in 1935.

26. Reginald Aldworth Daly House, MA (NR)
A geologist and head of the Department of Geology at Harvard from 1912-1942, who formulated a theory on the origins of igneous rocks and later published Igneous Rocks and Their Origin in 1914, who was also an early proponent of continental drift theory and anticipated aspects of plate tectonics.

27. James Dwight Dana House, CT (NR)
A Yale University geology professor who produced the first published works emphasizing that the study of geology was a much broader discipline than the examination of individual rocks.

28. George Davidson (Site TBD)
A geographer who conducted pioneering research for the Unites States Coast survey, founded the first astronomical observatory on the North American Pacific Coast, was the first geography professor at the University of California, Berkeley, and president of the American Association for the Advancement of Science.

29. William Morris Davis House, MA (NR)
A geology professor at Harvard who was influential in the development of meteorology and geomorphology as scientific disciplines and who developed the organizing theory of erosion.

30. Max Delbruck, (Site TBD)
A biophysicist who helped launch research into molecular biology and won the Nobel Prize in Physiology in 1969 with Salvador Luria and Alfred Hershey for discoveries concerning the replication and genetic structure of viruses.

31. Garden Park, CO "Bone Wars" site, CO
The famous Jurassic dinosaur site that was included in the "Bone Wars" dispute between Edward Drinker Cope and Othneil Charles Marsh, where several important dinosaur specimens have been recovered.

32. George Brown Goode (Site TBD)
An oceanic ichthyologist who was founder of the American Historical Society, head of the Smithsonian Institution, and a member of both the American Association for the Advancement of Science and the National Academies of Science.

33. Ice Age Floods Sites, WA
The site of cataclysmic floods that swept periodically across eastern WA and down the Columbia River Gorge at the end of the last ice age, which has been researched since the 1920s.

34. James Hall (NY) (NHL)
The office and lab of James Hall, a leading paleontologist who led geological research in North America in the 1800s and was the first President of the American Geological Society.

35. Hubbard Brook Forest, NH
The field research station conducting long-term ecological research where acid rain was first discovered and biogeochemistry budgets were first put together.

36. Lamont-Doherty Earth Observatory, NY
A research unit of Columbia University and observatory where scientists provided the first definitive evidence to support the theory of plate tectonics and continental drift, first explained the role of large-scale ocean circulation systems in abrupt climate change, and provided the first evidence that the Earth's inner core is spinning faster than the rest of the planet.

37. Lewiston, ID
Site of the Missoula flood deposits that overlie Bonneville flood conglomerates, documenting two mega flood sequences.

38. The Los Angeles City Oil Field (2nd Street Park site), CA
A large oil field located north of downtown Los Angeles where Edward Doheny's successful well resulted in a petroleum boom in the area and the oil field at one time being the highest producing in California, this site marks the birthplace of the petroleum industry we know today due to not only the discovery of oil beneath, but also the creation of a market for the product.

39. O.C. Marsh House, CT (NHL)
Home of the preeminent paleontologist, O.C. Marsh who discovered and described dozens of new dinosaur species and who formulated theories on the origins of birds.

40. Edward W. Morley House, (CT) (NR)
The physicist who is known for his collaboration with Albert A. Michelson on the Michelson-Morley experiment that is a fundamental test of special relativity theory, and for his work on the precise atomic weights of hydrogen and oxygen.

41. Museum of Comparative Zoology, Harvard, MA
Founded through efforts of Louis Agassiz, and made better known in recent years by the work of Stephen Jay Gould, the museum collection illustrates comparative relationships of organisms.

42. New Harmony Historic District, IN (NR)
A 19th century Utopian community that was known as a center of reform for mathematics education.

43. Old Naval Observatory, DC (NHL)
The observatory was under the leadership of Matthew Fontaine Maury, the father of modern oceanography, from 1844 and 1861 when he made his greatest contributions and it became widely known as a world center for advances in oceanography and navigational information.

44. Pleistocene Lakes, UT
Many of the unique geological characteristics of the Great Basin are due to the effects of Lake Bonneville, a prehistoric pluvial lake that covered much of Great Basin region.

45. Project Faultless, Nevada Test Site, NV
The site where the Atomic Energy Commission tested Project Faultless, the first calibration test for a series of underground thermonuclear tests, more powerful than any undertaken before.

46. San Andreas Fault, CA
As geologist/mineralogist for the 1854 Pacific Railroad Survey, William Phipps Blake noted indication of mass dislocation along what would later be referred to as the San Andreas Fault, the discovery of ancient Lake Cahuilla and the lowest elevation in the conterminous U.S.

47. San Juan Basin, NM
Where Edward Drinker Cope of the "Bone Wars" fame investigated mammalian paleofauna, including the oldest Paleocene assemblage which was found here.

48. Sauk County, Sloss type locality, WI
Location of the first of six cratonic sequences identified by Lawrence Sloss that formed the basis of sequence stratigraphy.

49. George Gaylord Simpson (Site TBD)
Called the most influential paleontologist of the 20th century, he was a professor of zoology at Columbia University and curator at the American Museum of Natural History.

50. Stockton Bar, Lake Bonneville, UT
G.K. Gilbert documented Lake Bonneville, a large freshwater lake of western Utah during the last Ice Age and recognized Stockton Bar as a huge sandbar, containing unique deposits that document a nearly continuous record of geologic history of Utah during the last Ice Age.

51. Temple Mountain, San Rafael Swell, UT
An Atomic Energy Commission Site that has a rich history of mining, notably Temple Mountain ore was sent to Marie Curie for her experiments, and the site supplied radium during World War I and uranium during World War II.

52. Willapa Bay, WA
Where peat swamps and drowned forests, documented by Brian Atwater, proved that the Pacific Northwest is prone to tsunamis during major earthquakes along the Cascadia subduction zone.

Life Sciences

53. Alexander Agassiz (Site TBD)
A chemist and engineer by training who was a specialist in marine ichthyology in the museum of natural history his father founded at Harvard, was also President of National Academies of Science and curator of Harvard Museum of Comparative Ecology.

54. Archbold Biological Station at Red Hill Research Site, FL (NR)
A 5000-acre research station built by biologist Richard Archbold, whose family supported conservation widely, including Glover-Archbold Park in DC.

55. Arnold Arboretum, MA (NHL)
One of the earliest botanic gardens established in the United States.

56. Spencer Fullerton Baird (Site TBD)
A leading naturalist/ornithologist who was the first curator of Smithsonian Institute and the second Secretary of the Smithsonian Institute.

57. Charles Herbert Best Home, ME (NR)
He worked with Frederick Banting to isolate insulin for the treatment of diabetes while still a medical student.

58. Liberty Hyde Bailey Birthplace, MI (NR)
A botanist/horticulturist whose most significant and lasting contributions were in the botanical study of cultivated plants.

59. John Bartram House, PA (NHL)
An 18th century botanist and horticulturalist whose garden is the oldest surviving botanic garden in North America, he was one of co- founders of the American Philosophical Society.

60. Willis Blatchley House, FL (NR)
An entomologist and malacologist who made contributions to the study of Coleoptera, Orthoptera, Hemiptera, and the freshwater mollusks of Indiana.

61. Body Farm, University of Tennessee, TN
Site where cadavers were used to develop forensic analysis, leading to more accurate criminal convictions and acquittals.

62. Norman Borlaug (Site TBD)
Known as the father of the Green Revolution, he studied wheat production and is one of only seven Americans to win the Nobel Prize, the Medal of Freedom, and the Congressional Gold Medal.

63. Luther Burbank House & Garden, CA (NR)
A horticulturist/botanist who developed more than 800 strains and varieties of plants over his 55-year career, his varied creations include fruits, flowers, grains, grasses, and vegetables.

64. John Burroughs, NY, (NHL)
A popular 19th-early 20th century naturalist and nature essayist, he was an early popularizer of nature and was active in the US conservation movement, supporting his friend President Theodore Roosevelt.

65. Rachel Carson House, ME (NHL)
Her seminal book, Silent Spring described the harmful effects of pesticides on the environment, and her writings are credited with advancing the global environmental movement.

66. College of Medicine Maryland, MD
Established in 1807, it was the first public and fifth oldest medical school in the US, and the first to institute a residency training program. Devidge Hall is the oldest building in the US still used for medical education.

67. Connecticut Agricultural Experiment Station, CT
Founded in 1875, it is the oldest state experiment station in the United States and serves as a state government facility that engages in scientific research and public outreach in agriculture and related fields.

68. Edward Drinker Cope House, PA (NHL)
Prolific paleontologist and herpetologist whose contributions helped define the field of American paleontology.

69. Gerty Cori (Site TBD)
She shared the 1947 Nobel Prize in Medicine with her husband for their work on how glycogen is broken down in muscle and how the body breaks down carbohydrates, and also did independent research on heredity human diseases.

70. Elliott Coues House, DC (NHL)
An ornithologist whose work was instrumental in establishing the currently accepted standards of trinomial nomenclature - the taxonomic classification of subspecies - in ornithology, and ultimately the whole of zoology.

71. **Theodosius Dobzhansky (Site TBD)**
An evolutionary biologist/geneticist who won the NAS Kimber Genetics Award in 1958, the National Medal of Science 1964, and the Franklin Medal in 1973.

72. **Charles Richard Drew House, VA**
African American surgeon who demonstrated that plasma has a longer life than whole blood, and whose leadership on stockpiling blood plasma saved lives during World War II. Though he was a director of the Red Cross Blood Bank in 1941, he resigned when Red Cross decided to segregate blood according to the race of the donor.

73. **Paul R. Ehrlich (Site TBD)**
A biologist best known for decades of dire predictions about the impacts of population growth and resource exhaustion, particularly in his controversial book, The Population Bomb, which asserted that the world's human population would soon increase to the point where mass starvation ensued.

74. **Asa Gray House, MA (NHL)**
Leading Harvard botanist who published the first complete work on American flora.

75. **Percy Lavon Julian (Site TBD)**
A research chemist who pioneered the synthesis of medical drugs from plants, and was one of the first African American PhDs in Chemistry and the second African American inducted into National Academies of Science from any field.

76. **Robert Kennicott House & Grove, IL (NHL)**
A 19th century naturalist and explorer who helped found the Chicago Academy of Sciences.

77. **Mary Claire King (Site TBD)**
A geneticist who identified the breast cancer gene, demonstrated that humans and chimps are 99% genetically identical, and applied genomic sequencing to identify victims of human rights abuse.

78. **Lab at Rockefeller University, NY**
The prominent laboratory dedicated to the advancement of science for human good, where Rebecca Lancefield did her work on streptococcal infections.

79. **Karl Landsteiner (Site TBD)**
The biologist and physician who co-discovered poliovirus and won the Nobel Prize in Medicine in 1930.

80. Aldo Leopold "Shack," WI (NR)
A 20th century wildlife biologist whose seminal book, Sand County Almanac (1949) is regarded as one of the founding books of modern environmentalism, and who was influential in development of modern conservation ethics and in the movement for wilderness protection.

81. James Logan House, PA (NHL)
An 18th century biologist/horticulturalist who discovered the vital role of pollen in the fertilization of corn.

82. Robert MacArthur (Site TBD)
An ecologist who had a major impact on many areas of community and population ecology, and played an important role in the development of niche partitioning; co-authored The Theory of Island Biogeography, a work which changed the field of biogeography and led to the development of modern landscape ecology.

83. Lynn Margulis (Site TBD)
A biologist who developed endosymbiotic theory, he was elected to the National Academy of Sciences in 1983 and won the National Medal of Science in 1999.

84. Mayo Clinic, MN
Where pathologist Philip Hench studied the effects of arthritis and determined that these effects can be reversible, and the site where he and others fostered development of wonder drugs beginning in 1940.

85. Ernst Mayr (Site TBD)
An evolutionary biologist, ornithologist, taxonomist, tropical explorer, and historian of science whose work contributed to the conceptual revolution that led to the modern evolutionary synthesis of Mendelian genetics, systematics and Darwinian evolution, and to the development of the biological species concept, for which he was awarded the Leidy Medal in 1946, the Darwin-Wallace Medal 1958, and the Crafoord Prize in 1967.

86. C. Hart Merriam Base Camp, AZ (NHL)
The field research site and base camp of Clinton Hart Merriam, the United States' first eco-biologist.

87. Missouri Botanical Garden, MO (NR)
Founded in 1859, the garden is one of the oldest botanical institutions in the United States.

88. Thomas Hunt Morgan (Site TBD)
An evolutionary biologist who won the Nobel Prize in Physiology or Medicine in 1933 for work that contributed to understanding the role chromosomes play in heredity.

89. New York Botanical Gardens, NY (NHL)
The 250-acre site's verdant landscape supports over one million living plants in extensive collections and operates one of the world's largest plant research and conservation programs, it includes the Pfizer Plant Research Laboratory, a pure research institution and the LuEsther T. Mertz Library, one of the most comprehensive botanical library in the world.

90. Old Scripps Building, CA (NHL)
The oldest oceanographic research building that has been continuously used in the United States.

91. Parke-Davis Research Laboratory, MI
A subsidiary of the pharmaceutical company Pfizer, which was once the world's largest pharmaceutical company, credited with building the first modern pharmaceutical laboratory and developing the first systematic methods of performing clinical trials of new medications.

92. Ellen Swallow Richards Residence, MA (NHL)
An industrial and environmental chemist, the first woman to graduate from the Massachusetts Institute of Technology and its first female instructor, she introduced revolutionary ideas about home sanitation and conducted pioneering work that led to the establishment of the field of home economics.

93. Jonas Salk (Site TBD)
A medical researcher and virologist who developed first polio vaccine, discovered Type B influenza virus, and won the Presidential Medal of Freedom 1977.

94. Margaret Sanger Clinic, NY
The facility that housed the Clinical Research Bureau, where founder of the National Birth Control League (later Planned Parenthood), and health reformer Margaret Sanger and her successors provided contraception services and conducted research from 1930 to 1973.

95. Saranac Lake, NY
Site where tuberculosis research was undertaken that contributed to understanding diseases.

96. Shedd Aquarium, IL (NR)
An indoor public aquarium opened on May 30, 1930.

97. Tuskegee Institute, AL (NHL)
Site of the Public Health Service syphilis experiment where 399 poor, African American sharecroppers were part of a study on the non-treatment and natural history of syphilis that led to measures regulating the protection of human subjects from experimentation.

98. **James D. Watson (Site TBD)**
A molecular biologist who co-discovered DNA and won the Nobel Prize in Physiology or Medicine in 1953.

99. **Worcester Foundation for Biomedical Research, MA**
The facility where Gregory Pincus, Catherine McCormack, and John Rock worked on oral contraceptives and the development of drugs to treat breast cancer.

100. **Jane Wright (Site TBD)**
The pioneering cancer researcher and surgeon noted for her contributions to chemotherapy, who is credited with developing the technique of using human tissue culture rather than laboratory mice to test the effects of potential drugs on cancer cells, and who also pioneered the use of the drug methotrexate to treat breast cancer and skin cancer.

Mathematical Sciences

101. **Henry Barnard House, CT (NR)**
Henry Barnard was an early champion of free public elementary education (common schools), and an early advocate of the metric system.

102. **G.D. Birkhoff House, MA (NHL)**
An early 20th century mathematician considered by many the preeminent American mathematician of his time, who is best known for the “ergodic theorem,” and his study of dynamical systems like the solar system.

103. **Sabbathday Lake Shaker Village, ME**
Established in 1782, 1783, or 1793, it was an early center for the production of teaching apparatus relating to the metric system, and the last active Shaker village in the US.

104. **United States Military Academy, NY**
Served as a center for mathematics education in the early 1800s.

Physics and Astronomy

105. **Adler Planetarium, IL (NR)**
America's first planetarium and part of Chicago's Museum Campus, which includes the John G. Shedd Aquarium and The Field Museum, its mission is to inspire exploration and understanding of the Universe.

106. Alabama Redstone Test Stand, AL (NR)
The site which was used to develop and test fire the Redstone missile, the first missile to detonate a nuclear weapon, the Jupiter-C rocket, the Juno I launch vehicle, that put the first American satellite, Explorer 1 into orbit, and Mercury-Redstone launch vehicle that carried the first American astronaut, Alan Shepard into space.

107. Benjamin Banneker, MD (Site TBD)
A largely self-taught 18th century African American astronomer who helped survey the District of Columbia and published Almanacs.

108. Hans Bethe (Site TBD)
A physicist who is best known for his contributions to the theory of nuclear reactions, especially his discoveries concerning the energy production in stars for which he won the Nobel Prize in Physics in 1967, and was head of the theoretical division of the Manhattan Project at Los Alamos.

109. Niels Bohr (Site TBD)
He won the Nobel Prize in Physics in 1922 for his services in the investigation of the structure of atoms and of the radiation emanating from them, and worked on the atom bomb at Los Alamos in WWII.

110. Percy Williams Bridgman House, MA (NHL)
A physicist who was awarded the Nobel Prize in 1946 for his work on the physics of high pressures, which led to machinery that produced the first artificial diamonds, and whose discoveries gave insight to the physical processes that take place within the earth.

111. Cape Canaveral Air Force Station, FL (NR)
A number of American space exploration "firsts" were launched here, including the first U.S. Earth satellite (1958), first U.S. astronaut (1961), and the first U.S. astronaut in orbit (1962).

112. Cincinnati Observatory, OH (NHL)
The oldest professional observatory in the United States, it currently operates as a 19th-century observatory.

113. Cinder Field, Astronaut Training Center, AZ
Astronauts Roger Chaffee, Mike Collins, Ed White, and others trained here in preparation for lunar missions.

114. Arthur H. Compton House, IL (NHL)
The physicist who discovered the Compton Effect, proving that light has both a particle and a wave aspect, shared the Nobel Prize in 1927, and led the Manhattan Project from the University of Chicago in WWII.

115. Cornell University Laboratory for Planetary Studies, NY
The Laboratory of physicist Carl Sagan, popularizer of astronomy in particular and science in general through his books *Broca's Brain* (1979) and *Cosmos* (1980).

116. Albert Einstein House, NJ (NHL)
The prominent theoretical physicist who developed the general theory of relativity, which is one of two pillars of modern physics, whose work is known for its influence on the philosophy of science, and who received the Nobel Prize in Physics in 1921.

117. Experimental Breeder Reactor No. 1, ID
This facility became the world's first electricity-generating nuclear power plant when it produced sufficient electricity to illuminate four 200-watt light bulbs.

118. Enrico Fermi (Site TBD)
Often referred to as the father of the atomic bomb, he was a physicist who won the Nobel Prize in Physics in 1938 for his work on induced radioactivity by neutron bombardment and the discovery of transuranic elements. He is also credited with creation of the first nuclear reactor, the Chicago Pile-1 and made significant contributions to the development of quantum theory, nuclear and particle physics, and statistical mechanics.

119. William Ferrel (Site TBD)
A 19th century meteorologist who studied atmospheric physics and hurricane prediction and worked for the United States Army Signal Service, which later became the United States Weather Bureau.

120. Richard Feynman (Site TBD)
A theoretical physicist who developed modern quantum thermodynamics for which he was awarded the Nobel Prize in Physics in 1965, who also popularized physics through books and lectures.

121. Gaithersburg Latitude Observatory, ME
One of six observatories, and one of the four original observatories built by 1899 tracking the degree of "wobble" occurring on the earth's north-south axis and resultant variation of latitude.

122. Murray Gell-Mann (Site TBD)
A theoretical physicist who was awarded the Nobel Prize in Physics in 1969 for his work on elementary particles and their interaction and formulated the theory of the quark as one of the fundamental constituents of matter.

123. Sheldon Lee Glashow (Site TBD)
A particle physicist who shared the Nobel Prize in Physics 1979 for his work on electroweak force theory, which unified electromagnetic and nuclear force theories.

124. Goddard Rocket Launching Site, MA (NR)
Launch site of the world's first successful liquid-fueled rocket by Robert H Goddard.

125. Hale Solar Observatory, CA
Lab of astronomer George Ellery Hale, known for inventing the spectrohelioscope (as an undergraduate at MIT) with which he made his discovery of solar vortices, he also established that sunspots are magnetic and played a key role in founding the National Research Council.

126. Edwin Hubble House, CA (NHL)
The astronomer who played a crucial role in establishing the field of extragalactic astronomy and is generally regarded as one of the most important observational cosmologists of the 20th century, known for showing that the recessional velocity of a galaxy increases with its distance from the earth, implying the universe is expanding, known as "Hubble's law."

127. Henry Joseph House, NJ (NHL)
A prominent 19th century physicist, he discovered the electromagnetic phenomenon of self-inductance, was the first secretary of the Smithsonian Institution, developed the electromagnet into a practical device, and invented a precursor to the doorbell.

128. Kennedy Space Center, FL
NASA's Launch Operations Center that was originally built for the Saturn V, the largest and most powerful operational launch vehicle in history constructed for the Apollo program, and since the end of the Apollo manned missions in 1972 has been used to launch every NASA human space flight.

129. Robert A. Millikan House, IL (NHL)
Physicist awarded the Nobel Prize in Physics in 1923 for his measurement of the elementary electronic charge and his work on the photoelectric effect.

130. Maria Mitchell (Site TBD)
At the forefront of American astronomy in 1847 when she spotted a blurry streak—a comet—through her telescope, she was the first woman to be elected to the American Academy of Arts and Sciences, and the first female astronomy professor in the United States (hired by Vassar College in 1865).

131. John von Neumann (Site TBD)
The mathematician/physicist who worked on the Manhattan Project and later worked to develop the hydrogen bomb.

132. J. Robert Oppenheimer (Site TBD)
The theoretical physicist, known as the father of the atomic bomb, who was head of the Manhattan Project and later became an advisor to the Atomic Energy Commission and an arms control advocate.

133. Portland Observatory, ME (NHL)
Historic maritime signal tower built in 1807 in Portland, ME that is the only known surviving tower of its type in the United States.

134. Propulsion and Structural Test Facility, AL
Site where the first single-stage rockets with multiple engines were tested and the Saturn Family of launch vehicles was developed.

135. Pupin Physics Laboratory, Columbia, NY (NR)
This lab is significant for its association with experiments relating to the splitting of the atom, achieved in connection with the Manhattan Project.

136. H.A. Rowland House, ME (NHL)
19th century physicist who was the first president of the American Physical Society and is remembered for the high quality of the diffraction gratings he made and the work he did with them on the solar spectrum.

137. Site of First Self-Sustaining Nuclear Reaction, IL
Site of the first man-made self-sustaining nuclear chain reaction, which was initiated in Chicago Pile-1 (the world's first artificial nuclear reactor) on December 2nd, 1942 under the supervision of Enrico Fermi.

138. Edward Teller (Site TBD)
The theoretical physicist known as father of the hydrogen bomb, though he earlier worked extensively on the atomic bomb at Los Alamos as well, and much later was the leading advocate of the Strategic Defense Initiative ("Star Wars").

139. Unitary Plan Wind Tunnel, CA
The research facility used extensively to design and test new generations of commercial and military aircraft as well as NASA space vehicles, including the Space Shuttle.

140. University of Illinois Observatory, IL
Observatory that played a key role in the development of astronomy as home to a key innovation in the area of astronomical photometry, and was directed at different times by notables such as Joel Stebbins and Robert Horace Baker.

141. U.S. Naval Academy, MD (NR)
Includes site of an early experiment of Academy graduate and physicist A.A. Michelson, the first US recipient of the Nobel Prize in 1907, who was later made notable for the Michelson-Morley experiment which forms one of the fundamental tests of special relativity theory.

Social Sciences

142. Administrative Building, Carnegie Institution of Washington, DC
A facility founded and endowed by Andrew Carnegie in 1902 to encourage scientific "investigation, research and discovery" that would lead "to the improvement of mankind."

143. American Philosophical Society Hall, PA (NR)
Now a museum, this is the original home of the eminent scholarly organization of international reputation that promoted useful knowledge in the sciences and humanities through excellence in scholarly research, professional meetings, publications, library resources, and community outreach.

144. Arts & Industries Building, Smithsonian, DC
Second oldest of the Smithsonian museums on the National Mall in Washington, D.C, the facility was initially named the National Museum and it was built to provide the Smithsonian Institution with its first proper facility for publicly displaying its growing collections.

145. Beginning Point of the U.S. Public Lands Survey, OH
Beginning point of the first mathematically designed cadastral survey conducted nationwide in a modern country in 1785, it opened what was then the Northwest Territory for settlement and is studied as a basis for land reform in other countries.

146. Franz Boas (Site TBD)
Known as the father of American anthropology, he was one of the most prominent opponents of scientific racism. He introduced the concept of cultural relativism, which holds that cultures cannot be objectively ranked as higher or lower, or better or more correct, but that all humans see the world through the lens of their own culture.

147. Noam Chomsky (Site TBD)
Often described as the father of modern linguistics, he has also been called the "world's top public intellectual," who entered the public consciousness through his vocal opposition to U.S. involvement in the Vietnam War in part through his essay “The Responsibility of Intellectuals” and came to be associated with the New Left while being arrested on multiple occasions for his anti-war activism.

148. Kenneth and Mamie Phipps Clark (Site TBD)
African-American PhD psychologist husband and wife team who became active in the civil rights movement, and whose research including their doll experiment on children's attitudes about race influenced the *Brown vs. Board of Education* decision, the Supreme Court case that determined that racial segregation in education is unconstitutional.

149. Daniel C. Gilman Summer Home, ME
First president of Johns Hopkins University, the first university in the United States founded with the express purpose of encouraging advanced scientific research.

150. Owenite Community, IN
The site of Robert Owen's utopian experiment where renowned teachers and scientists were assembled, including geologist William Maclure and zoologist and entomologist Thomas Say; though the site was closed after two years, several important outgrowths resulted, including the first US kindergarten, trade school, library, and public school system to offer equal educational opportunities for both girls and boys; the site also the original headquarters of the US Geological Survey.

151. Charles Wilson Peale House, PA (NHL)
Organized the first US biological and geological exploration expedition in 1801 and founded the Philadelphia Museum, later known as Peale's American Museum, a museum of natural history.

152. Peale's Baltimore Museum, MD (NR)
The first building specifically designed to be a museum (for paintings and natural history), established by Charles Wilson Peale.

153. Robbers Cave State Park, OK
Site of influential social conflict theory experiments conducted by Turkish-American social psychologist Muzafer Sherif, a founder of modern social psychology who developed several unique and powerful techniques for understanding social processes, particularly social norms and social conflict.

154. B.F. Skinner (Site TBD)
Psychologist, behaviorist, and social philosopher who won the National Medal of Science in 1968, he developed a philosophy of science that he called radical behaviorism and founded a school of experimental research psychology.